Evaluation of the Measure A Program as Part of the Monitoring of the Congestion Management Program

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EXECUTIVE SUMMARY

The City and County Association of Governments of San Mateo County (C/CAG) is the Congestion Management Agency (CMA) for San Mateo County. In this role C/CAG is responsible for the Congestion Management Program (CMP) and the Countywide Transportation Plan (CTP). As part of the Congestion Management Program and Countywide Transportation Plan, analysis of current and future transportation projects and land use patterns are performed. This report provides an evaluation of the Measure A Program as part of the monitoring of the Congestion Management Program. The data will be utilized for development of the 2005 Congestion Management Program and included in the update for the Countywide Transportation Plan.

The San Mateo County Transportation Authority (TA) has successfully completed numerous transportation system improvement projects as part of the original Measure A initiative. These projects have reduced travel times for motorists on highways and local streets in the County and for Caltrain riders. They have also improved safety and saved lives.

Fehr & Peers has quantified the results of existing Measure A projects, including auxiliary lanes on US 101, reconstruction of the US 101/Marsh Road Interchange, the slow vehicle climbing lane on SR 92, Caltrain baby bullet service, and Caltrain grade separations. Our findings are:

- US 101 auxiliary lanes will reduce travel times by up to 9 minutes per vehicle during commute hours
  - Travel time savings of over 7,100 hours will occur each day during peak periods
  - This translates to a gain of over $40 million per year in productivity (estimated cost of travel time)
  - Gasoline consumption will be reduced by approximately 5,600 gallon a day
  - Emissions of carbon monoxide, nitrogen oxides, and volatile organic compounds will be reduced by 12 percent
- Traffic accidents have reduced by over 20 percent on the sections of US 101 with completed auxiliary lanes
  - The accident reduction over the length of the project is projected to be 250 fewer accidents each year
- Traffic accidents have reduced 30 percent at the Marsh Road/US 101 Interchange after the Measure A improvements were constructed
- The improvements on SR 92 contributed to an accident reduction on that facility of 20 percent
  - Three years prior to the construction of the slow vehicle lane there were 14 head-on collisions. Since the completion of the project which included a median barrier head-on collisions have been eliminated
- Caltrain riders save 40 minutes each way on their commutes between San Francisco and San Jose with the new baby bullet service
  - The 5,600 riders a day will save 1,850 hours of travel time each day during peak hours
  - The total travel time savings in dollars is estimated to be $11.3 million a year

- Caltrain grade separations improve local traffic flow by eliminating the railroad gate down time. Their elimination improved travel times by over 260 hours per location per day during peak periods.

Similar results are expected to be realized by future Measure A projects. For example:

- Auxiliary lanes on I-280 could contribute to a reduction in accidents from 140 per year to 110 per year
- Auxiliary lanes on SR 92 could contribute to a reduction in accidents from 220 per year to 180 per year
- Improvements at the US 101/Woodside interchange are projected to contribute to an accident reduction from 140 to 100 per year
- Additional Caltrain grade separations would reduce travel time costs by over $2,000,000 per year just due to the reduced crossing times caused by eliminating the gates. Additional savings would be incurred due to reduced congestion at adjacent intersections.

1. INTRODUCTION

The City and County Association of Governments of San Mateo County (C/CAG) is the Congestion Management Agency (CMA) for San Mateo County. In this role C/CAG is responsible for the Congestion Management Program (CMP) and the Countywide Transportation Plan (CTP). As part of the Congestion Management Program and Countywide Transportation Plan, analysis of current and future transportation projects and land use patterns are performed. This report provides an evaluation of the Measure A Program as part of the monitoring of the Congestion Management Program. The data will be utilized for development of the 2005 Congestion Management Program and included in the update for the Countywide Transportation Plan.

Fehr & Peers has quantified the results of existing Measure A projects, including auxiliary lanes on US 101, reconstruction of the US 101/Marsh Road interchange, median and shoulder improvements on SR 92, Caltrain baby bullet service, and Caltrain grade separations. The results comprise both operational improvements (reduced travel times and reduced congestion) and safety improvements (accident reductions). Available operational analyses and accident data were used in our analysis.

The new Measure A Expenditure Plan contains several projects that are similar in scope to the projects completed under the existing Measure A program. The future projects include:

- Caltrain improvements
- Local shuttle service
- Accessible services for eligible seniors and people with disabilities
- San Mateo County ferry service
- San Mateo County/SFO BART extension assistance
- Dumbarton rail corridor station facilities and corridor improvements in Redwood City, Menlo Park, and East Palo Alto
- I-280 north improvements including reconstruction the I-280/SR 1 interchange and constructing auxiliary lanes between I-380 and Hickey Boulevard
- SR 1 improvements including replacing the SR 1/San Pedro Creek bridge, widening the SR 1/Manor Drive overcrossing, constructing safety and operational improvements on SR 1 and SR 92 in Half Moon Bay
- SR 92 improvements including auxiliary lanes and interchange improvements between I-280 and the San Mateo Hayward Bridge
- US 101 mid-county improvements including reconstructing the US 101/Brodway interchange, modifying the US 101/Peninsula Avenue interchange, and adding operational improvements on US 101 from Hillsdale Boulevard to SR 92
- US 101 south improvements including reconstructing the US 101/Woodside Road interchange, constructing improvements on US 101 from the Santa Clara County line to SR 84, and providing access improvements to Dumbarton Bridge
- Countywide supplemental roadway improvements
- Local streets/transportation assistance

- Caltrain grade separations
- Pedestrian and bicycle facilities
- Alternative congestion relief

The results of future Measure A projects were estimated based on the results derived from the existing projects.

2. EVALUATION OF EXISTING MEASURE A PROJECTS

The existing Measure A projects included in the evaluation are auxiliary lanes on US 101, reconstruction of the US 101/Marsh Road Interchange, the slow vehicle climbing lane on SR 92, Caltrain baby bullet service, and Caltrain grade separations.

US 101 AUXILIARY LANES

Auxiliary lanes will be constructed on US 101 from the Santa Clara County line to the Millbrae Avenue Interchange. These lanes have been completed between Ralston Avenue and Third Avenue and are currently under construction between Marsh Road and Ralston Avenue.

Travel time savings, accident reductions, energy savings and air quality improvements due to the auxiliary lanes were quantified. Analyses contained in the Project Study Reports for the three project segments, Santa Clara County Line to Marsh Road, Marsh Road to Hillsdale Boulevard, and Hillsdale Boulevard to Millbrae Avenue, conducted by Fehr & Peers, Caltrans, and Rajappan & Meyer, respectively, were used to estimate the travel time savings and the associated time cost savings due to delay reductions. Caltrans accident data was used to quantify accident reductions.

Travel Time Savings

Travel times for future conditions with and without the auxiliary lanes were obtained from the individual reports identified above. The projected travel times, and the travel time savings, from the Santa Clara County Line to Millbrae Avenue during the morning and evening commute periods are summarized in Table 1.

TABLE 1
US 101 PROJECTED TRAVEL TIMES[1] (IN MINUTES)

Scenario	Morning Commute Period		Evening Commute Period	
	Northbound	Southbound	Northbound	Southbound
Without Auxiliary Lanes	20.3	33.3	17.3	26.1
With Auxiliary Lanes	17.7	24.1	16.6	16.7
Travel Time Savings	2.6	9.2	0.7	9.4

1. Santa Clara County Line to Millbrae Avenue.

The travel times in the southbound direction with the auxiliary lanes are 9 minutes shorter during both the morning and evening commute periods. The travel time savings in the northbound direction are a bit lower and range from just less than 1 minute during the evening commute period to between 2 and 3 minutes during the morning commute period. More specific information regarding travel times between adjacent interchanges is presented in Table A-1 in the Appendix.

Productivity Savings

Every minute a person is delayed in traffic is a cost in terms of time away from family and more pleasurable activities and in terms of time that could be spent doing more productive work. The cost of the productivity gained with less time delayed in traffic due to the auxiliary lanes was estimated by multiplying the estimated

delay savings per person by an average wage in San Mateo County of $26.00 per hour. The delay per person was estimated by comparing the relative travel times for each segment on US 101 to determine the reduced delay per vehicle, multiplying the result by the number of vehicles on each segment to obtain vehicle hours of delay, and then applying an average vehicle occupancy of 1.16 people per vehicle. The delays per vehicle and the total person delays for each segment of US 101 for conditions with and without the auxiliary lanes are presented in Table A-1 in the Appendix.

The reduced travel times discussed above result in a reduction of 1,925 person-hours of delay during the morning commute hour each work day and 1,625 person-hours during the evening hourly period. The dollar cost of the delay savings on a daily and annual basis is summarized in Table 2.

TABLE 2
US 101 AUXILIARY LANES
DAILY AND ANNUAL TRAVEL TIME SAVINGS RESULTS

Peak Hour Time Savings (person hours)	
AM	1,925
PM	1,625
Congestion Duration (hours)	
AM	2
PM	2
Time Value of Congestion ($/person-hour)	$26
Daily Savings	***$185,000***
Work Days per Year	235
Annual Savings	***$43,400,000***

Accident Reductions

Auxiliary lanes on US 101 between SR 92 and Ralston Avenue were completed in 2002. A total of 257 annual accidents with two fatalities occurred on this stretch of US 101 prior to completion of the auxiliary lanes. Annually the accident rate has dropped to 203, with no fatalities, after the auxiliary lanes were added. This is an annual accident reduction of approximately 21 percent. Accidents with fatalities and/or injuries reduced 36 percent. The accident rate, which takes into account volume changes, reduced 19 percent. See Table A-2 in the Appendix for more details.

The average number of accidents within the limits of the auxiliary lane project for the last three years, from the Santa Clara County Line to Millbrae Avenue, has been approximately 1,200 accidents and 3 fatalities a year. It is impossible to determine whether the accident reduction on the SR 92 to Ralston Avenue segment is solely due to the auxiliary lanes. However, if the entire project length experiences a similar accident reduction, the expected number of accidents reduced on the entire length would be 250 accidents a year.

Energy Savings and Air Quality Improvements

The reduction in congestion due to the US 101 auxiliary lanes will reduce the amount of fuel consumed and will improve air quality through reduced emissions. General estimates of fuel consumption savings and emissions reductions were derived from formula developed by Oak Ridge National Labs and the Southern

California Air Quality Management District using projected 2020 volumes and travel conditions on US 101 between Millbrae Avenue and the Santa Clara County Line, both with and without the auxiliary lanes. Reduced emissions include carbon monoxide (CO), nitrogen oxides (NOx), and volatile organic compounds (VOC). The results are summarized in Table 3.

TABLE 3
US 101 AUXILIARY LANES
DAILY FUEL CONSUMPTION AND AIR QUALITY RESULTS

Scenario	Fuel Consumption (Gallons)	CO Emissions (lb)	NOx Emissions (lb)	VOC Emissions (lb)
2020 Without Project				
AM	12,300	1,900	370	440
PM	10,800	1,660	320	390
Daily	46,200	7,120	1380	1660
2020 With Project				
AM	10,800	1,670	320	390
PM	9,500	1,460	280	340
Daily	40,600	6,260	1200	1460
Reduction				
AM	1,500	230	50	50
PM	1,300	200	40	50
Daily	5,600	860	180	200
% Reduction				
AM	12.2%	12.1%	13.5%	11.4%
PM	12.0%	12.0%	12.5%	12.8%
Daily	12.1%	12.1%	13.0%	12.0%

Notes:
CO = Carbon Monoxide
NOx = Nitrogen Oxides
VOC = Volatile Organic Compounds
Fuel Consumption and emissions calculated based on formulae developed by Oak Ridge National Labs and used in traffic engineering software such as SYNCHRO and TRANSYT 7-F.
Daily numbers are based on two times the AM and PM numbers.

The fuel consumption and emission reductions were calculated for the AM and PM peak hours, based on the results of the future traffic operations analyses in the PSRs. Daily estimates were conservatively estimated as the sum of twice the AM and twice the PM reductions. The auxiliary lanes are estimated to save 5,600 gallons of gasoline a day. The corresponding daily emission reductions are 860 pounds of carbon monoxide, 180 pounds of nitrogen oxides, and 200 pounds of volatile organic compounds. On an annual basis that translates to the elimination of 109 tons of carbon monoxide, 10 tons of nitrogen oxides and 25 tons of volatile organic compounds.

US 101/MARSH ROAD INTERCHANGE

The reconstruction of the US 101/Marsh Road Interchange included the upgrading Marsh Road overcrossing from two lanes to four lanes, eliminating the northbound US 101 to westbound Marsh Road loop ramp and modifying the remaining ramps for safety and operational improvements.

Accident Reductions

Caltrans accident data was obtained to evaluate safety improvements associated with the project. A total of 22 annual accidents occurred on US 101 in the vicinity of Marsh Road prior to completion of the project. Annual accidents were reduced to 15 afterwards. This is an annual accident reduction of approximately 30 percent. The number of rear-end accidents reduced from 27 a year before the improvements to 7 a year afterwards. See Table A-3 in the Appendix for more details.

SR 92 SLOW VEHICLE CLIMBING LANE

A slow vehicle climbing lane which included a median barrier was constructed on SR 92 from SR 35 to Pilarcitos Creek.

Accident Reductions

A total of 23 annual accidents, with one fatality, occurred on this section of SR 92 prior to completion of the project, based on Caltrans accident data. Nineteen annual accidents, and no fatalities, occurred afterwards. This is an annual accident reduction of approximately 21 percent. The number of injury and fatal accidents decreased from 11 to 6, a reduction of 47 percent. Head-on accidents were completely eliminated. The accident rate, which takes into account volume changes, reduced 20 percent. See Table A-4 in the Appendix for more details.

CALTRAIN BABY BULLET SERVICE

Caltrain baby bullet service provides express passenger rail service between San Francisco and San Jose with stops at Millbrae, Hillsdale, Redwood City, Palo Alto, and Mountain View. Track sidings, to allow baby bullet trains to pass slower trains, grade separations (see below), and limited stops have improved travel times between San Francisco and San Jose to less than one hour, a savings of almost 40 minutes.

The daily ridership on the Caltrain baby bullet service is approximately 5,600 riders a day. The reduced travel times result in a reduction of 1,850 person-hours of delay during the morning and evening commute hours each workday. The dollar cost of the delay savings on a daily and annual basis is summarized in Table 4.

TABLE 4
CALTRAIN BABY BULLET SERVICE
DAILY AND ANNUAL TRAVEL TIME SAVINGS RESULTS

Peak Hour Time Savings (person hours)	
AM and PM	1,850
Time Value of Congestion ($/person-hour)	$26
Daily Savings	***$48,000***
Work Days per Year	235
Annual Savings	***$11,300,000***

CALTRAIN GRADE SEPARATIONS

Numerous roadways cross the Caltrain tracks. Gates are used to prevent vehicles from traveling over the tracks while a train is passing. These gates are down for 30 to 60 seconds for each train crossing. Not only do the gates stop vehicles for those intervals, they also create congestion, cause vehicles to block adjacent intersections, and increase the travel times for those individuals whose travel path crosses the railroad tracks.

Grade separations, where the road goes over or under the tracks eliminating the need for gates, have been constructed at numerous locations in San Mateo County due to the current Measure A. These locations are:

- Oyster Point Boulevard (South San Francisco)
- Millbrae Avenue (Millbrae)
- Ralston Avenue (Belmont)
- Harbor Avenue (Belmont)
- Holly Street (San Carlos)
- Brittan Avenue (San Carlos)
- Howard Avenue (San Carlos)
- Jefferson Avenue (Redwood City)
- 5th Avenue (San Mateo County)

Travel time savings were evaluated at one of the crossings, Ralston Avenue, to assess the results of the Caltrain grade separations.

Ralston Avenue

Ralston Avenue is the main east-west arterial in Belmont. It crosses the Caltrain tracks, just south of the Belmont Caltrain Station, about 130 feet east of the Ralston Avenue/El Camino Real intersection. Train crossings directly contributed to congestion at the Ralston Avenue/El Camino Real intersection. Thus, travel time savings due to the Ralston Avenue grade separation were evaluated by calculating the gate down times and simulating vehicle operations at the crossing and the adjacent Ralston Avenue/El Camino Real intersection.

There are eight northbound and southbound trains (four that stop at the nearby Belmont train station and four that travel through) that cross Ralston Avenue during the AM peak period (7:00 am to 9:00 am). The gates are down for 60 seconds while the southbound trains are stopped and 30 seconds for all other crossings, for a total of 10 minutes. During the AM peak hour there are 900 westbound vehicles and 1,300 eastbound vehicles at the crossing.

During the PM peak period (5:00 pm to 7:00 pm), there are eight northbound and southbound trains (four that stop and four that travel through). The gates are down for a total of 10 minutes. During the PM peak hour there are 950 eastbound vehicles and 1,300 westbound vehicles at the crossing.

The reduced crossing times result in a reduction of 40 person-hours of delay during the morning commute hour each work day and 90 person-hours during the evening peak hourly period at the crossing and at the intersection. The dollar cost of the delay savings on a daily and annual basis is summarized in Table 5.

TABLE 5
RALSTON AVENUE GRADE SEPARATION
DAILY AND ANNUAL TRAVEL TIME SAVINGS RESULTS

Peak Hour Time Savings (Person Hours)	
AM	40
PM	90
Congestion Duration (hours)	
AM	2
PM	2
Time Value of Congestion ($/person-hour)	$26
Daily Savings	***$6,800***
Work Days per Year	235
Annual Savings	***$1,600,000***

The savings are approximately $6,800 per day and $1.6 million annually. Similar savings at the other eight grade separations would result in a total savings of over $12 million a year in San Mateo County.

3. EVALUATION OF FUTURE MEASURE A PROJECTS

Several of the projects contained in the new Measure A program are similar to projects that have been constructed under the existing Measure A program. Therefore, it is expected that they will have similar results. A few of the projects with similar attributes are auxiliary lanes on I-280 between I-380 and Hickey Boulevard, auxiliary lanes on SR 92 between US 101 and I-280, interchange improvements at US 101 and Woodside Road, and additional Caltrain grade separations.

I-280 AUXILIARY LANES

Auxiliary lanes will be constructed on I-280 between I-380 and Hickey Boulevard. This section of I-280 has experienced 140 accidents and no fatalities each year, based on data obtained from Caltrans for the past three years. The auxiliary lanes are projected to contribute to a decrease the accidents by up to 20 percent, based on the accident reductions caused by the auxiliary lanes on US 101.

SR 92 AUXILIARY LANES

Auxiliary lanes will also be constructed on SR 92, between US 101 and I-280. The accident history on this section of SR 92 is 220 accidents and 2 fatalities a year. The auxiliary lanes are projected to contribute to a decrease the accidents by up to 20 percent, or over 40 accidents a year.

US 101/WOODSIDE ROAD INTERCHANGE

The US 101/Woodside Road interchange will be re-constructed as part of the new Measure A program. The section of US 101 in the vicinity of the interchange has experienced 140 accidents and no fatalities each year, based on data obtained from Caltrans for the past three years. The interchange improvements are projected to contribute to a decrease in the number of accidents by 30 percent based on the accident reductions at the US 101/Marsh Road interchange. This would result in 40 fewer accidents a year for a total of 100 annual accidents.

CALTRAIN GRADE SEPARATIONS

The new Measure A program will fund approximately 10 additional Caltrain grade separations. The new grade separations will improve travel times across the tracks. Based on Ralston Avenue, this will result in $1,600,000 savings per grade separation per year. With ten grade separations the total travel time savings correlates to a savings of over $16,000,000 per year.

APPENDIX

Table A-1
US 101 Auxiliary Lanes
Speeds, Travel Times, and Delays

Northbound 101 - AM Peak Hour

			Free Flow Travel		Existing						Future No Project						Future With Project						Reduced		Reduced
From	To	Segment Length (ft)	Speed (mph)	Travel Time (min)	Speed (mph)	Travel Time (min)	Delay Per Veh (Min)	Volume	Vehicle Miles of Travel	Total Delay (Person Hour) [1]	Speed (mph)	Travel Time (min)	Delay Per Veh (Min)	Volume	Vehicle Miles of Travel	Total Delay (Person Hour) [1]	Speed (mph)	Travel Time (min)	Delay Per Veh (Min)	Volume	Vehicle Miles of Travel	Total Delay (Person Hour) [1]	Delay/ Veh (min)	Reduced Delay/ Veh (%)	Delay (Person Hours)
County Line	University Ave	3850	65	0.67	40	1.09	0.42	6400	4667	51.8	30	1.46	0.79	7670	5593	116.74	40	1.09	0.42	7945	5793	64.29	0.37	-46.8%	52.45
University Ave	Willow Rd	3123	65	0.55	56	0.63	0.08	6430	3803	9.9	35	1.01	0.46	7045	4167	62.44	56	0.63	0.08	7390	4371	11.39	0.38	-82.6%	51.05
Willow Rd	Marsh Rd	7487	65	1.31	56	1.52	0.21	5945	8430	24.1	55	1.55	0.24	6570	9316	30.38	56	1.52	0.21	6905	9791	27.94	0.03	-12.5%	2.44
Marsh Rd	Woodside Rd	7109	65	1.24	49	1.65	0.41	6530	8792	51.6	50	1.62	0.38	7045	9485	51.58	50	1.62	0.38	7265	9782	53.19	0	0.0%	-1.61
Woodside Rd	Whipple Ave	5250	65	0.92	55	1.08	0.16	7001	6961	21.6	35	1.70	0.78	7495	7452	112.63	56	1.07	0.15	7899	7854	22.83	0.63	-80.8%	89.81
Whipple Ave	Redwood Shores / Holly St	8450	65	1.48	56	1.71	0.23	7679	12289	34.0	55	1.75	0.27	8514	13626	44.29	46	2.09	0.61	8878	14208	104.34	*-0.34*	125.9%	-60.05
Redwood Shores / Holly St	Ralston Ave	3750	65	0.66	56	0.76	0.1	7356	5224	14.2	50	0.85	0.19	8182	5811	29.95	30	1.42	0.76	8492	6031	124.35	*-0.57*	300.0%	-94.39
Ralston Ave	Hillsdale Blvd	7050	65	1.23	56	1.43	0.2	7540	10068	29.1	35	2.29	1.06	8431	11257	172.18	23	3.48	2.25	8682	11592	376.36	*-1.19*	112.3%	-204.18
Hillsdale Blvd	SR 92	1300	65	0.23	56	0.26	0.03	8583	2113	5.0	27	0.55	0.32	9637	2373	59.42	25	0.59	0.36	9648	2375	66.92	-0.04	12.5%	-7.50
SR 92	Kehoe Ave	1584	65	0.28	33	0.55	0.27	8279	2484	43.1	15	1.20	0.92	8335	2501	147.74	55	0.33	0.05	8547	2564	8.23	0.87	-94.6%	139.51
Kehoe Ave	3rd Ave	1584	65	0.28	51	0.35	0.07	8408	2522	11.3	15	1.20	0.92	8517	2555	150.97	55	0.33	0.05	8715	2615	8.40	0.87	-94.6%	142.57
3rd Ave	Dore Ave	2112	65	0.37	44	0.55	0.18	8792	3517	30.5	15	1.60	1.23	8889	3556	210.65	55	0.44	0.07	9256	3702	12.48	1.16	-94.3%	198.17
Dore Ave	Peninsula Ave	3696	65	0.65	37	1.15	0.5	8503	5952	81.9	35	1.20	0.55	8421	5895	89.23	55	0.76	0.11	8847	6193	18.75	0.44	-80.0%	70.48
Peninsula Ave	Anza Blvd	4752	65	0.83	54	1	0.17	8844	7960	29.0	55	0.98	0.15	8769	7892	25.34	55	0.98	0.15	9208	8287	26.61	0	0.0%	-1.27
Anza Blvd	Broadway	1584	65	0.28	45	0.4	0.12	8805	2642	20.4	55	0.33	0.05	8678	2603	8.36	55	0.33	0.05	9080	2724	8.75	0	0.0%	-0.39
Broadway	Millbrae Ave	4752	65	0.83	50	1.07	0.24	8822	7940	40.8	55	0.98	0.15	8636	7772	24.96	55	0.98	0.15	9059	8153	26.18	0	0.0%	-1.22
Corridor		67433	65	11.81	50	15.20	3.39		95364	498.1	38	20.27	8.46		101854	1336.9	43	17.66	5.85		106037	961.0	2.61	-30.9%	375.86
County Line	Woodside Rd	21569	65	3.77	50	4.89	1.12		25692	137.3	43	5.64	1.87		28561	261.1	50	4.86	1.09		29737	156.8	0.78	-41.7%	104.33
Woodside Rd	SR 92	25800	65	4.52	56	5.24	0.72		36656	103.8	41	7.14	2.62		40519	418.5	34	8.65	4.13		42061	694.8	-1.51	57.6%	-276.32
SR 92	Millbrae Ave	20064	65	3.52	45	5.07	1.55		33016	256.9	30	7.49	3.97		32774	657.3	55	4.15	0.63		34238	109.4	3.34	-84.1%	547.85

Northbound 101 - PM Peak Hour

			Free Flow Travel		Existing						Future No Project						Future With Project						Reduced		Reduced
From	To	Segment Length (ft)	Speed (mph)	Travel Time (min)	Speed (mph)	Travel Time (min)	Delay Per Veh (Min)	Volume	Vehicle Miles of Travel	Total Delay (Person Hour) [1]	Speed (mph)	Travel Time (min)	Delay Per Veh (Min)	Volume	Vehicle Miles of Travel	Total Delay (Person Hour) [1]	Speed (mph)	Travel Time (min)	Delay Per Veh (Min)	Volume	Vehicle Miles of Travel	Total Delay (Person Hour) [1]	Delay/ Veh (min)	Reduced Delay/ Veh (%)	Delay (Person Hours)
County Line	University Ave	3850	65	0.67	35	1.25	0.58	9420	6869	105.3	56	0.78	0.11	10160	7408	21.53	13	3.37	2.70	10805	7879	562.08	-2.59	2354.5%	-540.54
University Ave	Willow Rd	3123	65	0.55	35	1.01	0.46	8670	5128	76.8	38	0.93	0.38	9495	5616	69.52	29	1.22	0.67	10205	6036	131.73	-0.29	76.3%	-62.22
Willow Rd	Marsh Rd	7487	65	1.31	38	2.24	0.93	8440	11968	151.2	56	1.52	0.21	9030	12804	36.54	65	1.31	0.00	9605	13620	0.00	0.21	-100.0%	36.54
Marsh Rd	Woodside Rd	7109	65	1.24	24	3.37	2.13	8455	11384	347.0	58	1.39	0.15	9220	12414	26.65	59	1.37	0.13	9405	12663	23.56	0.02	-13.3%	3.09
Woodside Rd	Whipple Ave	5250	65	0.92	55	1.08	0.16	6109	6074	18.8	56	1.07	0.15	6349	6313	18.35	57	1.05	0.13	6740	6702	16.88	0.02	-13.3%	1.47
Whipple Ave	Redwood Shores / Holly St	8450	65	1.48	56	1.71	0.23	6466	10348	28.7	56	1.71	0.23	6889	11025	30.53	57	1.68	0.20	7256	11612	27.96	*0.03*	-13.0%	2.57
Redwood Shores / Holly St	Ralston Ave	3750	65	0.66	57	0.75	0.09	6202	4405	10.8	57	0.75	0.09	6123	4349	10.62	58	0.73	0.07	6474	4598	8.73	*0.02*	-22.2%	1.89
Ralston Ave	Hillsdale Blvd	7050	65	1.23	56	1.43	0.2	7390	9867	28.5	56	1.43	0.20	7466	9969	28.77	57	1.41	0.18	7796	10409	27.04	*0.02*	-10.0%	1.73
Hillsdale Blvd	SR 92	1300	65	0.23	57	0.26	0.03	7511	1849	4.3	57	0.26	0.03	7917	1949	4.58	56	0.26	0.03	8116	1998	4.69	0	0.0%	-0.12
SR 92	Kehoe Ave	1584	65	0.28	49	0.37	0.09	7762	2329	13.5	45	0.40	0.12	7807	2342	18.05	55	0.33	0.05	8018	2405	7.72	0.07	-58.3%	10.33
Kehoe Ave	3rd Ave	1584	65	0.28	40	0.45	0.17	7784	2335	25.5	15	1.20	0.92	7916	2375	140.31	55	0.33	0.05	8135	2441	7.84	0.87	-94.6%	132.48
3rd Ave	Dore Ave	2112	65	0.37	46	0.52	0.15	8194	3278	23.7	35	0.69	0.32	8352	3341	51.49	55	0.44	0.07	8640	3456	11.65	0.25	-78.1%	39.84
Dore Ave	Peninsula Ave	3696	65	0.65	42	1	0.35	7876	5513	53.1	55	0.76	0.11	8034	5624	17.03	55	0.76	0.11	8322	5825	17.64	0	0.0%	-0.61
Peninsula Ave	Anza Blvd	4752	65	0.83	47	1.15	0.32	7836	7052	48.3	25	2.16	1.33	7965	7169	204.10	55	0.98	0.15	8289	7460	23.96	1.18	-88.7%	180.15
Anza Blvd	Broadway	1584	65	0.28	56	0.32	0.04	8090	2427	6.2	25	0.72	0.44	8393	2518	71.15	55	0.33	0.05	8705	2612	8.39	0.39	-88.6%	62.76
Broadway	Millbrae Ave	4752	65	0.83	48	1.12	0.29	8205	7385	45.8	35	1.54	0.71	8417	7575	115.14	55	0.98	0.15	8712	7841	25.18	0.56	-78.9%	89.96
Corridor Total		67433	65	11.81	43	18.03	6.22		98211	987.5	44	17.31	5.50		102791	864.3	46	16.55	4.74		107557	905.0	0.76	-13.8%	-40.69
County Line	Woodside Rd	21569	65	3.77	31	7.87	4.1		35349	680.3	53	4.62	0.85		38243	154.2	34	7.27	3.5		40197	717.4	-2.65	311.8%	-563.14
Woodside Rd	SR 92	25800	65	4.52	56	5.23	0.71		32544	91.1	56	5.22	0.7		33605	92.8	57	5.13	0.61		35320	85.3	0.09	-12.9%	7.54
SR 92	Millbrae Ave	20064	65	3.52	46	4.93	1.41		30319	216.1	31	7.47	3.95		30943	617.3	55	4.15	0.63		32040	102.4	3.32	-84.1%	514.90

Table A-1 (Continued)
US 101 Auxiliary Lanes
Speeds, Travel Times, and Delays

Southbound 101 - AM Peak Hour

			Free Flow Travel		Existing						Future No Project						Future With Project						Reduced		Reduced
From	To	Segment Length (ft)	Speed (mph)	Travel Time (min)	Speed (mph)	Travel Time (min)	Delay Per Veh (Min)	Volume	Vehicle Miles of Travel	Total Delay (Person Hour) [1]	Speed (mph)	Travel Time (min)	Delay Per Veh (Min)	Volume	Vehicle Miles of Travel	Total Delay (Person Hour) [1]	Speed (mph)	Travel Time (min)	Delay Per Veh (Min)	Volume	Vehicle Miles of Travel	Total Delay (Person Hour) [1]	Delay/ Veh (min)	Reduced Delay/ Veh (%)	Delay (Person Hours)
Millbrae Ave	Broadway	6336	65	1.11	27	2.7	1.59	9213	11056	282.2	15	4.80	3.69	10005	12006	711.30	55	1.31	0.20	10439	12527	40.22	3.49	-94.6%	671.07
Broadway	E. Poplar Ave	10560	65	1.85	34	3.5	1.65	9234	18468	293.5	25	4.80	2.95	10281	20562	584.34	55	2.18	0.33	10470	20940	66.57	2.62	-88.8%	517.77
E. Poplar Ave	3rd Ave	3138	65	0.55	29	1.25	0.7	9783	5814	131.9	35	1.02	0.47	10878	6465	98.50	55	0.65	0.10	11479	6822	22.12	0.37	-78.7%	76.39
3rd Ave	SR 92	3696	65	0.65	10	4.15	3.5	10117	7082	682.2	55	0.76	0.11	11010	7707	23.33	55	0.76	0.11	12054	8438	25.55	0	0.0%	-2.21
SR 92	Hillsdale Blvd	2410	65	0.42	57	0.48	0.06	8409	3838	9.7	57	0.48	0.06	8310	3793	9.61	55	0.50	0.08	8821	4026	13.60	-0.02	33.3%	-3.99
Hillsdale Blvd	Ralston Ave	7025	65	1.23	35	2.28	1.05	9179	12213	185.7	42	1.90	0.67	9195	12234	118.70	32	2.49	1.26	9999	13304	242.74	-0.59	88.1%	-124.04
Ralston Ave	Redwood Shores / Holly St	2425	65	0.42	40	0.69	0.27	7915	3635	41.2	51	0.54	0.12	7868	3614	18.19	18	1.53	1.11	8714	4002	186.36	-0.99	825.0%	-168.17
Redwood Shores / Holly St	Brittan St	3035	65	0.53	13	2.65	2.12	7957	4574	325.0	13	2.65	2.12	8048	4626	328.72	15	2.30	1.77	8675	4986	295.83	0.35	-16.5%	32.89
Brittan St	Whipple Ave	3275	65	0.57	14	2.66	2.09	7986	4953	321.6	14	2.66	2.09	8018	4973	322.86	16	2.33	1.76	8744	5424	296.50	0.33	-15.8%	26.36
Whipple Ave	Woodside Rd	4210	65	0.74	26	1.84	1.1	7321	5837	155.2	35	1.37	0.63	7432	5926	90.21	56	0.85	0.11	8181	6523	17.34	0.52	-82.5%	72.87
Woodside Rd	Marsh Rd	7354	65	1.29	28	2.98	1.69	9000	12535	293.0	19	4.40	3.11	8870	12354	531.48	26	3.21	1.92	9195	12807	340.14	1.19	-38.3%	191.34
Marsh Rd	Willow Rd	7523	65	1.32	21	4.07	2.75	8330	11869	441.4	15	5.70	4.38	8850	12610	746.83	26	3.29	1.97	9395	13386	356.59	2.41	-55.0%	390.24
Willow Rd	University Ave	3143	65	0.55	31	1.15	0.6	8680	5167	100.3	32	1.12	0.57	9310	5542	102.24	29	1.23	0.68	9895	5890	129.64	-0.11	19.3%	-27.40
University Ave	County Line	3552	65	0.62	33	1.22	0.6	9360	6297	108.2	38	1.06	0.44	9960	6700	84.43	26	1.55	0.93	10520	7077	188.50	-0.49	111.4%	-104.06
Corridor		67682	65	11.85	24	31.62	19.77		113338	3371.2	23	33.26	21.41		119112	3770.8	32	24.18	12.33		126152	2221.7	9.08	-42.4%	1549.07
Millbrae Ave	SR 92	23730	65	4.16	23	11.6	7.44		42420	1389.9	24	11.38	7.22		46740	1417.5	55	4.9	0.74		48727	154.5	6.48	-89.8%	1263.02
SR 92	Woodside Rd	22380	65	3.91	24	10.6	6.69		35051	1038.3	26	9.6	5.69		35166	888.3	25	10	6.09		38265	1052.4	-0.4	7.0%	-164.08
Woodside Rd	County Line	21572	65	3.78	26	9.42	5.64		35868	942.9	20	12.28	8.5		37206	1465.0	26	9.28	5.5		39160	1014.9	3.0	-35.3%	450.13

Southbound 101 - PM Peak Hour

			Free Flow Travel		Existing						Future No Project						Future With Project						Reduced		Reduced
From	To	Segment Length (ft)	Speed (mph)	Travel Time (min)	Speed (mph)	Travel Time (min)	Delay Per Veh (Min)	Volume	Vehicle Miles of Travel	Total Delay (Person Hour) [1]	Speed (mph)	Travel Time (min)	Delay Per Veh (Min)	Volume	Vehicle Miles of Travel	Total Delay (Person Hour) [1]	Speed (mph)	Travel Time (min)	Delay Per Veh (Min)	Volume	Vehicle Miles of Travel	Total Delay (Person Hour) [1]	Delay/ Veh (min)	Reduced Delay/ Veh (%)	Delay (Person Hours)
Millbrae Ave	Broadway	6336	65	1.11	29	2.5	1.39	8709	10451	233.2	25	2.88	1.77	10621	12745	362.20	55	1.31	0.20	11400	13680	43.93	1.57	-88.7%	318.27
Broadway	E. Poplar Ave	10560	65	1.85	40	3	1.15	8905	17810	197.3	25	4.80	2.95	10386	20772	590.31	55	2.18	0.33	11116	22232	70.68	2.62	-88.8%	519.63
E. Poplar Ave	3rd Ave	3138	65	0.55	35	1.02	0.47	9083	5398	82.2	35	1.02	0.47	10663	6337	96.56	55	0.65	0.10	11310	6722	21.79	0.37	-78.7%	74.77
3rd Ave	SR 92	3696	65	0.65	38	1.1	0.45	9360	6552	81.2	55	0.76	0.11	10919	7643	23.14	55	0.76	0.11	11563	8094	24.51	0	0.0%	-1.36
SR 92	Hillsdale Blvd	2410	65	0.42	56	0.49	0.07	9091	4149	12.3	56	0.49	0.07	10550	4815	14.23	56	0.49	0.07	10710	4888	14.44	0	0.0%	-0.22
Hillsdale Blvd	Ralston Ave	7025	65	1.23	54	1.48	0.25	8950	11908	43.1	38	2.10	0.87	10169	13530	170.45	56	1.43	0.20	10655	14176	41.06	0.67	-77.0%	129.40
Ralston Ave	Redwood Shores / Holly St	2425	65	0.42	57	0.48	0.06	7776	3571	9.0	56	0.49	0.07	8972	4121	12.10	56	0.49	0.07	9381	4309	12.65	0	0.0%	-0.55
Redwood Shores / Holly St	Brittan St	3035	65	0.53	58	0.59	0.06	8288	4764	9.6	58	0.59	0.06	9240	5311	10.68	57	0.61	0.08	9713	5583	14.97	-0.02	33.3%	-4.29
Brittan St	Whipple Ave	3275	65	0.57	58	0.64	0.07	7587	4706	10.2	58	0.64	0.07	8493	5268	11.45	57	0.65	0.08	9170	5688	14.13	-0.01	14.3%	-2.68
Whipple Ave	Woodside Rd	4210	65	0.74	55	0.87	0.13	6832	5447	17.1	55	0.87	0.13	7681	6124	19.24	56	0.85	0.11	8357	6663	17.71	0.02	-15.4%	1.53
Woodside Rd	Marsh Rd	7354	65	1.29	28	2.98	1.69	7995	11135	260.3	17	4.92	3.63	8140	11337	569.30	50	1.67	0.38	8235	11470	60.29	3.25	-89.5%	509.00
Marsh Rd	Willow Rd	7523	65	1.32	16	5.34	4.02	7600	10829	588.6	21	4.07	2.75	8100	11541	429.17	25	3.42	2.10	8565	12204	346.54	0.65	-23.6%	82.63
Willow Rd	University Ave	3143	65	0.55	60	0.6	0.05	8130	4840	7.8	27	1.32	0.77	8540	5084	126.69	32	1.12	0.57	9050	5387	99.39	0.2	-26.0%	27.31
University Ave	County Line	3552	65	0.62	58	0.7	0.08	8005	5385	12.3	35	1.15	0.53	8795	5917	89.81	38	1.06	0.44	9180	6176	77.82	0.09	-17.0%	11.99
Corridor		67682	65	11.85	35	21.79	9.94		106946	1564.4	29	26.10	14.25		120546	2525.3	46	16.69	4.84		127272	859.9	9.41	-66.0%	1665.41
Millbrae Ave	SR 92	23730	65	4.16	35	7.62	3.46		40211	593.9	29	9.46	5.3		47498	1072.2	55	4.9	0.74		50728	160.9	4.56	-86.0%	911.30
SR 92	Woodside Rd	22380	65	3.91	56	4.55	0.64		34546	101.3	49	5.18	1.27		39169	238.2	56	4.52	0.61		41308	115.0	0.66	-52.0%	123.19
Woodside Rd	County Line	21572	65	3.78	25	9.62	5.84		32189	869.1	21	11.46	7.68		33879	1215.0	34	7.27	3.49		35236	584.0	4.19	-54.6%	630.92

1. Total delay calculated based on Person /Veh => 12% HOV at average occupancy of 2.3 1.16

Notes:
Millbrae to Hillsdale from 101 Aux Lane DTOAR, Rajappan & Meyer, Jan. 2001
Millbrae to Hillsdale Future NP and WP speeds are the average of min and max values
Millbrae to Hillsdale Future NP and WP travel times are calculated based on avg speed and section length
Existing Year 1998
Future Year 2025
Notes:
Hillsdale to Marsh from 101 Aux Lane OAFR, CALTRANS, Aug. 1998
Existing Year 2000 (forecasted)
Future Year 2020
Distances from an average of Mapquest and Thomas Guide lengths

Notes:
Marsh to Embarcadero from 101 Aux Lane TOR, Fehr & Peers, Feb. 2003
Marsh to Embarcadero existing, Future NP and WP travel times are calculated based on avg speed and section length
Existing Year 2000
Future Year 2025
Future volumes reported are demand volumes, not served volumes
Future with Project includes Aux lanes to Embarcadero

Table A-2
US 101 Auxiliary Lanes
Accident Reductions

Table A
Caltrans Accident Data
US 101 Between Hillsdale Blvd. & Ralston Ave.

	Length	Time	Accidents				Accident Rate / MVM		
	(Mile)	(Months)	Total	Fatal	F+I	MVM	Total	Fatal	F+I
Before (March 1999 - Feb. 2001)	1.401	24	198	1	63	245.82	0.81	0.004	0.26
After (July 2002 - Dec. 2003)	1.401	18	63	0	22	176.27	0.36	0.000	0.12
Accident Reduction Rates							0.45	0.004	0.13

Notes:

F+I = Fatal plus Injury Accidents
MVM = Million Vehicle Miles of Travel

Table B
Annualized Accident Data
US 101 Between Hillsdale Blvd. & Ralston Ave.

	Length	Time	Accidents				Accident Rate / MVM		
	(Mile)	(Months)	Total	Fatal	F+I	MVM	Total	Fatal	F+I
Before	1.401	12	99	0.5	32	122.91	0.81	0.004	0.26
After	1.401	12	42	0.0	15	117.51	0.36	0.000	0.12
Annual Accident Reductions			57	0.5	17	5.40	0.45	0.004	0.13
Annual Accident Reductions per Mile			41	0.4	12				

Note:

Caltrans accident data presented in Table A normalized to present comparable number of accidents for the before and after scenarios.

Table C
Annual Accident Reductions Based on Total Length of Auxiliary Lanes
US 101

	Accidents		
	Total	Fatal	F+I
Annual Accidents Reduced	522	5	154

Note:

Total length of the proposed auxiliary lanes is 12.82 miles. Annual accidents reduced calculated by multiplying annual accident reductions per mile (Table B) by 12.82

Table A-3
US 101/Marsh Road Interchange
Accident Reductions

Table A
Caltrans Accident Data
US 101/Marsh Road Interchange

	Time (Months)	Accidents		
		Total	Fatal	F+I
Before (Jan. 1994 - Dec. 1995)	24	44	0	15
After (May 1999 - Oct. 2000)	18	23	0	5

Notes:

F+I = Fatal plus Injury Accidents

MVM = Million Vehicle Miles of Travel

Table B
Annualized Accident Data
US 101/Marsh Road Interchange

	Time (Months)	Accidents		
		Total	Fatal	F+I
Before	12	22	0	8
After	12	15	0	3
Annual Accident Reductions		7	0	4
% Accident Reduction		30%	0%	56%

Note:

Caltrans accident data presented in Table A normalized to present comparable number of accidents for the before and after scenarios.

Table A-4
SR 92
Accident Reductions

Table A
Caltrans Accident Data
SR 92 Between SR 35 and Pilarcitos Creek

	Length	Time	Accidents				Accident Rate / MVM			Average Accident Rate / MVM		
	(Mile)	(Months)	Total	Fatal	F+I	MVM	Total	Fatal	F+I	Total	Fatal	F+I
Before (March 1995 - Feb. 1997)	1.901	24	46	1	21	32.33	1.42	0.031	0.65	1.30	0.029	0.63
After (Feb. 2000 - Jan. 2002)	1.901	24	30	0	12	32.32	0.93	0.000	0.37	1.30	0.029	0.63
Accident Reduction Rates							0.49	0.031	0.28			

Notes:

F+I = Fatal plus Injury Accidents

MVM = Million Vehicle Miles of Travel

Table B
Annualized Accident Data
SR 92 Between SR 35 and Pilarcitos Creek

	Length	Time	Accidents				Accident Rate / MVM			Average Accident Rate / MVM		
	(Mile)	(Months)	Total	Fatal	F+I	MVM	Total	Fatal	F+I	Total	Fatal	F+I
Before	1.901	12	23	0.5	11	16.17	1.42	0.031	0.65	1.30	0.029	0.63
After	1.901	12	15	0.0	6	16.16	0.93	0.000	0.37	1.30	0.029	0.63
Annual Accident Reductions			8		5	0.00	0.49	0.031	0.28			
% Accident Reductions			35%		43%							

Note:

Caltrans accident data presented in Table A normalized to present comparable number of accidents for the before and after scenarios.